

Forum

Thirsty Planet

The world is experiencing a major water crisis that will continue to worsen unless current conditions change, says the World Bank. An August World Bank report stated that 30 countries containing 40% of the world's population are already experiencing water shortages that threaten their agriculture, industry, and health.

According to the report, population growth and contamination of water are the major causes of these water shortages. The report was prepared for the World Bank's fifth annual water symposium, which was held August 13–18 in Stockholm. In presenting the report at the conference, Ismail Serageldin, vice president of the World Bank, said, "The water problem in most countries stems not from a shortage of water, but rather mainly from inefficient and unsustainable use of water resources, a situation that cannot continue."

The report states that most of the countries experiencing water shortages are in areas where populations are growing quickly, such as the Middle East, North Africa, Central Asia, and sub-Saharan Africa. Other areas facing water shortages include northern China, western and southern India, western South America, Pakistan, and Mexico. Pollution is also a large problem affecting water in Eastern Europe.

World population is predicted to grow from the current 5.6 billion people to 8 billion people in 2025, which will result in higher agricultural, domestic, and industrial demand for water. Historically, global demand for water has increased at a rate of about 2.3% a year, doubling every 21 years, according to the report. But current and projected water supplies will not meet this demand.

The report points out that the supply of potable water throughout the world is being contaminated through pollution sources such as domestic wastes, industry, agricultural chemicals, and mismanaged land use. According to the report, contaminated water now causes 80% of the diseases in developing countries and kills 10 million people annually. "This decline in water quality can be seen in many developing countries," Serageldin said in a press release. "Most rivers in and around cities and towns in these countries are little more than open, stinking sewers that not only degrade the aesthetic life of the city but also constitute a reservoir for cholera and other water-related diseases."

About 95% of the world's sewage and a growing amount of industrial waste are now being dumped directly into rivers and streams. Even middle-income countries rarely treat sewage. For example, Buenos

Aires treats only 2% of its sewage, which is typical for Latin America, states the report.

To thwart the impending water crisis, the World Bank says that \$600 billion should be invested in global water resources over the next 10 years. Most of the \$600 billion should be raised by the countries that are in danger, says the report, but the bank estimates that \$60 billion must come from other countries. The bank plans to lend \$30–40 billion of the \$60 billion.

To encourage conservation of water resources, the report emphasizes that water must be viewed as an economic good and priced appropriately. It recommends that water resources must be managed carefully, through balancing benefits and costs, and by placing more emphasis on consumer participation, economic incentives, and private sector funding.

"The trend toward privatization will pick up, especially when facilities hit rock bottom," Serageldin said. "Offering private enterprise the incentives to work efficiently now appears to be the way to provide the most services at the lowest price for the poor. The coming water crisis can be averted by this joint effort of the private sector, individuals, national and local governments, and international agencies."

The World Bank, which is the largest international financier of water projects, has a keen interest in water management issues, according to Sarwat Hussein of its media relations department. "We view water as a precious resource and are interested in seeing that it's priced properly," he said. Since 1950, the World Bank has lent more than \$36 billion for investments in irrigation, water supply, sanitation, flood control, and hydropower.

Breathing Trees

By absorbing carbon dioxide to make oxygen, plants provide the very air we breathe. Now, researchers are discovering another important benefit of carbon dioxide-loving plants: the potential to help slow global warming.

In a study published in the August 25 issue of *Science*, Pieter Tans, a geochemist at the National Oceanic and Atmospheric Administration, and colleagues report that in 1992–1993, plants absorbed up to half the



Unquenchable thirst? Global water demand doubles every 21 years, but projected supplies will not meet the demand.

Northern Hemisphere's carbon dioxide emissions. "That's much more than any terrestrial plant ecologist would have considered likely," Tans said. Conserving tree and plant populations, he added, might raise their carbon dioxide uptake even higher.

Understanding how carbon cycles through plants is vital to decreasing global warming. By burning fuel and clearing forests, human activity generates 7 billion tons of carbon dioxide into the atmosphere every year. About half of it remains there. The rest is believed to be absorbed by oceans and plants, though no one knows exactly how the gas is distributed.

In the atmosphere, carbon dioxide molecules allow sunlight to reach the earth's surface. At night, reradiated energy from earth surfaces is absorbed, trapping heat temporarily like glass in a greenhouse. According to the Intergovernmental Panel on Climate Change, increasing concentrations of carbon dioxide in the atmosphere may cause the world's average surface temperature to rise by up to 6.3°F over the next century. Some subtropical areas will become tropical, disrupting ecosystems and allowing animal and microbe species that thrive in a hot climate to migrate into more northern and southern latitudes. Global warming may also increase rainfall and cause the sea level to rise.

The best way to slow global warming, scientists say, is to cut back on burning fossil fuels like oil, coal, and gas. Some have suggested disposing of excess carbon dioxide by pumping it into the ocean, which can absorb vast amounts of the gas. But pumping would be expensive, and concentrated streams of carbon dioxide-rich water would kill many ocean organisms.

The Tans study is one of the first to suggest that saving trees might help keep the earth cool. In the study, glass flasks were used to collect 8,000 air samples at 43 sites throughout the Northern Hemisphere, on the oceans, and in Australia. Researchers checked the air samples for an isotopic "fingerprint" unique to plants. When accumulating carbon dioxide, oceans absorb the carbon-12 and carbon-13 isotopes in roughly equal proportion. Plants, however, absorb far more carbon-12, allowing leftover carbon-13 to build up in the air.

"When we looked at our air samples," Tans explains, "the carbon was enriched with C13." Measuring isotope concentrations and the carbon-12/carbon-13 ratio, the researchers found plants had accumulated up to half the fossil fuel emissions for 1992 and 1993.

Paul Quay, a professor of oceanography at the University of Washington, said that although the study was well designed, its findings are preliminary. "One thing you

have to be aware of is that the study only looks at two years of data," Quay said. "As the records become longer, we'll see if those two years are anomalous or representative."

The study offers two potential reasons for its unusually high rate of plant carbon dioxide uptake: regrowth of American forest once used for farms, and "fertilization" of forests worldwide by increased environmental nitrogen and carbon dioxide, which may enhance plant growth.

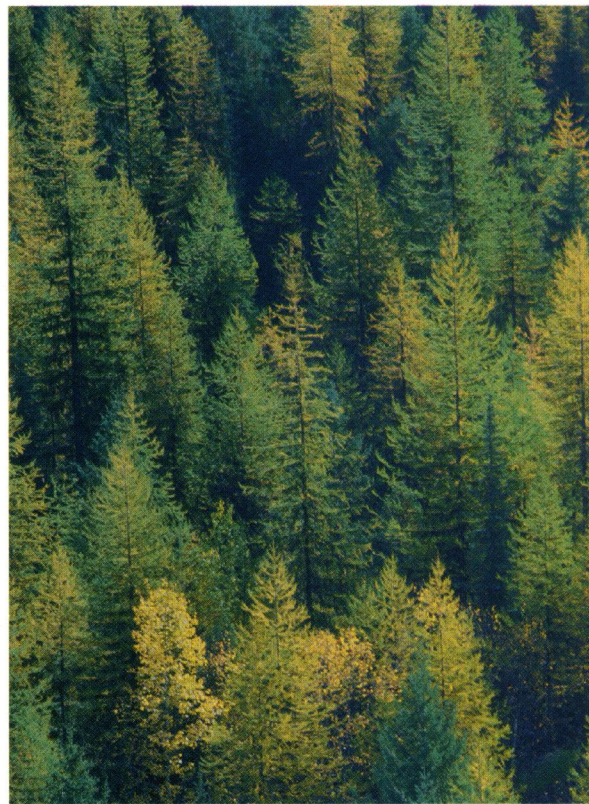
Many carbon dioxide cycle questions still lack answers, such as where, and for how long, do plants store atmospheric carbon. Tree trunks are one storage spot. But researchers worry that some carbon dioxide simply enters leaves of trees and decays back into the atmosphere within a year. "It's very important to pin down how the carbon cycle is working in order to make policy decisions on things like conservation," noted Mike MacCracken, director of the Office of the U.S. Global Change Program.

Meanwhile, James White, a geology professor at the University of Colorado and co-author of the Tans study, cautioned that simply planting trees won't solve the global warming problem. "Neither will dumping all the carbon dioxide in the ocean," White said. "We've got to fix the energy problem. Or else this will be something serious for our great, great grandchildren to deal with."

Nowhere to Hide

It has been 11 years since the release of methyl isocyanate in Bhopal, India caused about 2,000 deaths and greatly heightened public awareness of the potential dangers of chemical accidents worldwide. In the aftermath of Bhopal, a variety of steps were taken in the United States to minimize the possibility that such a disastrous event would occur here, including national and local legislation and voluntary action by industrial groups.

In August of this year, the National Environmental Law Center and the U.S. Public Interest Research Group published a report, *Nowhere to Hide*, suggesting that we have not done enough. The authors of the report conclude that "at least one out of every six Americans lives within a vulnerable zone—the area in which there could be seri-



Air care. Researchers found that plants had accumulated up to half the fossil fuel emissions of carbon dioxide for 1992 and 1993.

ous injury or death in the event of a chemical accident."

As a result of these dangers, the authors recommend that companies should be required to prepare a technology options analysis of alternatives that would eliminate or substantially reduce accident hazards, that the Chemical Safety and Hazard Investigation Board, mandated by the 1990 Clean Air Act Amendments to investigate major accidents and make recommendations for improving safety, be promptly reinstated, and that industry and government agencies should prepare and publicly communicate their worst-case accident estimates.

The authors emphasize that the report is only a screening tool for comparing disaster potential in different zip codes around the United States. The comparison is based on a calculation of the maximum vulnerable radius around each facility containing chemicals, assuming failure of all safety and mitigation systems, and total release of facility chemicals classified as Extremely Hazardous Substances by the EPA under the Emergency Planning and Community Right to Know Act of 1986. These areas are then summed for all facilities and chemicals in each zip code, and the sum is used as the measure of disaster potential for that zip code. Using this method, a zip code in Louisiana (70734), where a number of com-